PHYS 311 – Mechanics

Fall Semester 2023

August 25, 2023

Instructor

Robert Streubel | Office: Jorgensen Hall 310C | Email: streubel@unl.edu

Office Hours: Mondays, Wednesdays, and Fridays after class, or by appointment

Grader: Omar Taha (otaha2)

Pre-requisites: PHYS 212 and MATH 221

Lectures: Mondays, Wednesdays and Fridays, 9:30 thru 10:20, JH 249

Textbooks

Primary: Classical Mechanics, H. Goldstein, C. Poole, and J. Safko, Addison Wesley / Pearson (conceptual, upper-level standard)

Secondary: Introduction to Classical Mechanics with Problems and Solutions, D. Morin, Cambridge (lots of examples and solutions, first-year honors students)

Reference: Mechanics: Volume 1, L. D. Landau and E. M. Lifshitz, Butterworth-Heinemann (FYI: Landau-Lifshitz book series are the standard for theoretical physics, grad school level)

Course Overview

Course Objectives

This course primarily focuses on non-relativistic classical mechanics with emphasis on Lagrange's and Hamilton's formulation, i.e., using Lagrangian and Hamiltonian. These formulations are applicable to virtually all fields in physics, including relativistic mechanics, quantum mechanics, particle physics, electrodynamics, and quantum electrodynamics. Hence, understanding the concepts, mathematical tricks, and physical background are of utmost importance. The three objectives are:

1. Reinforce your understanding of classical mechanics using advanced mathematical and physical concepts,
2. Use of integration and differentiation to solve differential equations, and
3. Improve your presentation style of complex physical concepts and mathematical equations.

A time investment of **at least 10 hours per week** is needed in addition to lectures.

Course Activities

Lecture. The lecture sessions introduce the fundamentals of classical mechanics. Lecture notes will be provided to digest the two textbooks.

Homework. There will be homework every week assigned at the first class of the week and due the following Monday in class, independent of whether an exam is scheduled or not.

Participation. One or two students will be randomly selected to present their homework solution in class on Monday. Presentation style and preparedness will be evaluated, i.e., do not just copy your solution from the sheet of paper.

Exams. There will be two 60-minute midterm exams and a four-hour comprehensive final exam. They will be closed book. You can prepare and use one US letter cheat sheet with relevant equations to prevent memorization of mathematical equations.

Late Work. A 10% penalty per workday (up to 50%) is taken from work that is turned in after the due date.

Canvas. Class information, including syllabus, announcements, materials etc. will be posted and updated on the UNL Canvas page.

Instructional Continuity Guidance. If in-person classes are canceled, you will be notified of the instructional continuity plan for this class by Canvas.

UNL Course Policies and Resources. Students are responsible for knowing the university policies and resources found at `https://go.unl.edu/coursepolicies`.

Exams and Grading

Mid-term Exams (in-class): Monday, September 25 and Monday, October 30

Final Exam: 10am thru 2pm, Tuesday, December 12

Grading Scale

The grades will be determined from your final score using the table below. The table shows the lower cutoff for a grade. For example, if your score is greater or equal to 80% but less than 85% you will get a B+.

Score	95	90	85	80	75	70	65	60	57	53	50
Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D

Homework	25%
Participation	10%
Two mid-term exams (15% each)	30%
Final exam	35%

Participation includes in-class presentation and discussion of homework problems.

A single instance of academic dishonesty may result in a failing grade for the course. Academic dishonesty includes copying solutions for homework, recitations, or exams either from another student or from existing solutions, whether published or not. Students are allowed to discuss homework with each other, but copying is considered cheating. For more examples of what is considered academic dishonesty, see the Student Code of Conduct (`http://stuafs.unl.edu/ja/code/three.shtml`).

Course Content

Set 1

1. Survey of elementary physics
2. Variational principles and Lagrange's equations

Set 2

3. The Hamilton equation of motion
4. The central force problem

Set 3

5. The rigid body equations of motion
6. Oscillations

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.